

Human Antirabies Treatment in the United States, 1972

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APPROXIMATELY 30,000 PERSONS in the United States each year reportedly receive antirabies treatment (1). However, the accuracy of this estimate, the circumstances leading to treatment, and the kinds of treatment administered have never been documented nationally. The epidemiology of treatment in individual States, for example, in Illinois and Georgia, has been described (2-4), but treatment data have never been compiled at the national level. Because the data and conclusions in these earlier reports may reflect biases peculiar to those States, we decided to review the information on antirabies treatment from all available sources in the United States to obtain a more representative portrayal of the epidemiologic factors involved in the initiation of antirabies treatment and to determine the actual treatment that is provided.

Data on antirabies treatment are not routinely cumulated at the Federal health level, and when, as in most States, antirabies biologicals are procured by private physicians from commercial sources, treatment information is usually not available to State health agencies. Nevertheless, we asked the health departments in all 49 States where rabies occurs (rabies-free Hawaii being omitted) if they had appropriate data. Only Delaware, Florida, Georgia, Illinois (exclusive of the Cook County-Chicago area), North Dakota, and South Carolina were able to supply information on what they estimated to be 75 percent or more of the persons receiving antirabies treatment in their jurisdictions. Similar data were avail-

able for New York City. Data provided by these seven areas for 1972, which related to 965 persons treated for rabies exposure, are the basis of our report. (We use the term "exposure" to include all persons given antirabies treatment, whether or not actual exposure to rabies was proved. Therefore epidemiologic parameters are given for all treated persons, even though many of them may not have been actually exposed to rabies.)

Results

When the cumulated 1972 data were evaluated and those for each reporting area compared, major differences were noted in the epidemiology and treatment of rabies among the seven jurisdictions. The distribution by jurisdiction of the 965 persons on whom we obtained data was as follows:

Jurisdiction	Number of persons	Percent of total ¹
Delaware	5	5
Florida	106	11
Georgia	98	10
Illinois	147	15
New York City	465	48
North Dakota	95	10
South Carolina	49	5

¹ Percentages do not add to 100 because of rounding.

The questions we asked fell into three general categories: (a) victims—location at time of exposure, age, and sex; (b) exposure—month of occurrence, animal involved, anatomical site of exposure, and type of exposure (bite or nonbite); and (c) treatment—time from exposure to initiation of treatment, number of doses of vaccine, and whether antirabies serum was administered. Only the location at time of exposure and sex were supplied for all 965 patients. Table 1 shows the number

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of answers to the various questions provided by the reporting jurisdictions.

Age. The exposure rate was highest in the younger age groups, particularly in persons less than 20 years old (table 2); 47 percent of all persons treated for whom

age was given were under 20, and 20 percent were under 10. When the 13 percent of patients for whom age was not specified were distributed proportionately among the age groups, the proportion under 10 years increased to 23 percent, and the proportion of persons 10-19 years increased to 31 percent.

Table 1. Number of responses to questions on antirabies treatment of 965 persons, by reporting jurisdiction

Question	New York City	Delaware	Florida	Georgia	Illinois	North Dakota	South Carolina	Total
Total persons treated	465	5	106	98	147	95	49	965
Sex of patient	465	5	106	98	147	95	49	965
Age of patient	453	5	99	83	77	76	49	842
Exposing animal	455	5	102	96	137	94	46	935
Month of exposure	419	4	96	91	139	95	43	887
Doses of vaccine	442	2	98	97	68	95	44	846
Antirabies serum	314	0	85	86	6	9	37	537
Treatment delay	414	4	91	88	71	91	42	801

Table 2. Age and sex distribution of the 965 persons receiving antirabies treatment, by species of exposing animal

Person's age group (years)	Dog		Other domestic animal		Wildlife		Unknown		Total		Both sexes
	Males	Females	Males	Females	Males	Females	Males	Females	Males	Females	
0-9	98	44	11	8	21	2	9	1	139	55	194
10-19	110	60	16	14	37	16	4	1	167	91	258
20-29	50	29	9	5	10	6	6	1	75	41	116
30-39	26	11	5	0	11	2	1	1	43	14	57
40-49	51	12	5	5	5	8	2	0	63	25	88
50-59	27	15	5	2	7	2	1	1	40	20	60
60 or more	37	16	5	4	4	1	1	1	47	22	69
Unknown	22	11	50	20	14	6	0	0	86	37	123
Total	421	198	106	58	109	43	24	6	660	305	965

Sex. More than two-thirds (68 percent) of the 965 persons treated were males. This male-to-female ratio of approximately 2 to 1 held for all age groups irrespective of the exposing animal (table 2). The risk of exposure for males was greater in the northern States, while the risk was similar for both sexes in South Carolina, Georgia, and Florida.

Exposing animal. The species of animal responsible for the rabies exposure was identified in 935 cases (table 3). In 619 of these cases (66 percent), dogs were involved, and in the rest of the cases, approximately equal numbers of other domestic animals—164 cases (18 percent)—and of wildlife—152 cases (16 percent).

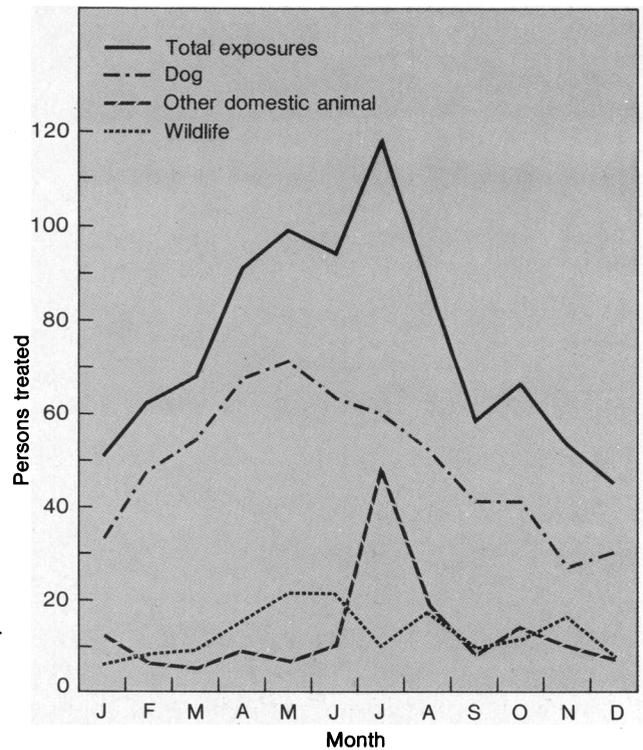
The kind of animal involved varied markedly according to the reporting source. For example, in New York City, 449 (99 percent) of the 455 persons treated for rabies exposure were treated for exposures by dogs. If the New York City data are omitted from consideration, the distribution of the exposing animals for the remaining 480 cases is more evenly divided: dogs—170 cases (35 percent); other domestic animals—162 cases (34 percent); and wildlife—148 cases (31 percent). However, even among these 480 cases, the distribution of the exposing animals varied with the reporting area. In North Dakota, dogs accounted for 26 percent of the exposures, other domestic animals for 54 percent, and wildlife for 20 percent. In South Carolina, Florida, and Georgia (taken collectively because of the similarity in results), dogs accounted for 32 percent of the exposures, other domestic animals for only 22 percent, and wildlife for 46 percent.

Month of exposure. Although people were treated for rabies exposure in every month of the year, 55 percent of the 887 persons treated for whom data were available received treatment in the period April through August.

Table 3. Distribution of the 965 persons receiving antirabies treatment, by reporting jurisdiction and exposing animal

Reporting jurisdiction	Dog	Domestic animal	Wildlife	Unknown	Total
Delaware	1	0	4	0	5
Florida	33	22	47	4	106
Georgia	24	26	46	2	98
Illinois	66	57	14	10	147
New York City	449	2	4	10	465
North Dakota	24	51	19	1	95
South Carolina ...	22	6	18	3	49
Total	619	164	152	30	965

Figure 1. Monthly distribution of 887 persons receiving anti-rabies treatment in 1972



The seasonal fluctuation in exposures involving dogs generally paralleled that for total exposures (fig. 1).

The seasonal curves also varied by reporting area. The July peak in total exposures and in exposures involving other domestic animals was primarily the result of a large increase in exposures involving livestock that were reported in Illinois and North Dakota during that month.

Kinds of exposure and anatomical site. Because of some ambiguity in the questions relating to type of exposure (bite, scratch, and so forth) and anatomical site (head, neck, and so forth), in analyzing these related questions, we deleted those responses that were contradictory and uninterpretable. In those cases in which the kind of exposure was identified, bites accounted for 89 percent, scratches for 3 percent, and other nonbite exposures (such as saliva contact) for 8 percent. Of the 794 exposures involving bites in which the anatomical site was identified, 552 persons (70 percent) were bitten by dogs, 128 (15 percent) by wildlife, and 114 (14 percent) by other domestic animals (table 4).

In the cases involving dogs, exposure was on the lower extremities in 49 percent and on the upper extremities in 29 percent. In contrast, exposure was on the upper

extremities in 60 percent of the cases involving other domestic animals and in 73 percent of those involving wildlife.

Treatment regimens. The seven health departments provided information on the number of doses of rabies vaccine administered for 846, and information on the use of antirabies serum for 537, of the 965 persons who reportedly received antirabies treatment. Treatment regimens of the persons who received duck embryo vaccine varied considerably (table 5); 25 percent received fewer than 14 doses, 45 percent received 14, and 27 percent received more than 14. The mode was 14 doses and the mean 12. Exposures involving wildlife resulted in the most intensive treatment: 16 percent of the persons exposed to rabies by wildlife got more than 21 doses of vaccine, in comparison with only 1 percent of the persons exposed by dogs and 4 percent of the persons exposed by other domestic animals.

Treatment regimens varied considerably from one reporting jurisdiction to another. In New York City, 36 percent of the persons treated got less than 14 doses of vaccine and 25 percent got less than 6, and fewer than 1 percent received antiserum. By contrast, 90 percent of the persons treated in Georgia got 14 or more doses of vaccine, and 26 percent got 21 or more

doses. Georgia was also the State in which the highest proportion of persons were treated with antirabies serum; 35 (41 percent) of the 86 persons for whom data were available on such treatment got serum plus vaccine. In the other jurisdictions, the use of antirabies serum fell somewhere between the two extremes.

Delay in initiating treatment. Delay in initiating treatment for rabies was common: for only 52 (6.5 percent) of the 801 persons for whom data were available did treatment start the day of exposure (fig. 2). The percentage of exposed persons treated increased continuously from day 1 through day 10, averaging an 8 percent increase daily. By day 10, treatment had been initiated for 85 percent of the persons exposed. After 10 days, the rate of initiation of treatment slowed markedly. Even as late as day 20 after exposure, 29 persons (4 percent) had not yet received prophylaxis: 13 of these persons began treatment between day 31 and day 60 after exposure, and 2 persons were not treated until more than 120 days after exposure. The average delay between exposure and the start of treatment was approximately 4½ days.

The source of the exposure was a factor in treatment delay. In exposures involving wildlife or domestic animals other than dogs, the average delay in initiation

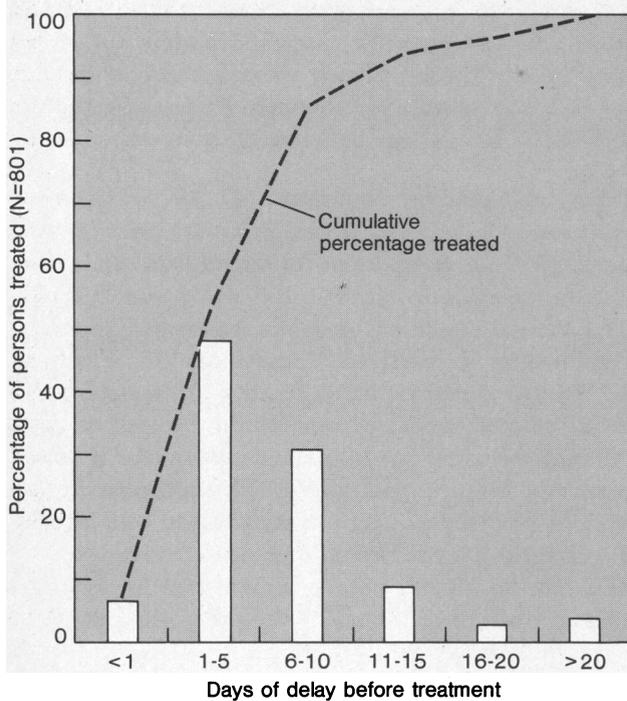
Table 4. Distribution of the 935 persons receiving antirabies treatment, by exposing animal, kind of exposure, and for persons bitten—the anatomical site

Exposing animal	Bitten on—				Exposed in other or unknown way	Total
	Head or neck	Arm or hand	Leg or foot	Torso		
Dog	49	188	269	46	67	619
Other domestic	4	79	19	12	50	164
Wildlife	8	93	25	2	24	152
Total	61	360	313	60	141	935

Table 5. Distribution of 965 persons receiving antirabies treatment, by exposing animal, doses of vaccine received, and whether or not antirabies vaccine was administered

Exposing animal	Doses of rabies vaccine					Antirabies serum			Total
	1-13	14	15-21	> 21	Unknown	Yes	No	Unknown	
Dog	188	205	177	7	42	6	363	250	619
Other domestic	18	80	8	4	54	14	42	108	164
Wildlife	22	79	12	22	17	26	78	48	152
Unknown	8	14	2	0	6	0	8	22	30
Total	236	378	199	33	119	46	491	428	965

Figure 2. Days of delay before initiation of antirabies treatment



of treatment was less than 3 days, whereas for exposures involving dogs, the average delay was approximately 5 days. However, the longer delay for exposures involving dogs probably can be largely attributed to the New York City cases, in which the interval between exposure and treatment averaged 6 days.

Discussion

A major objective of our study was to obtain data on the epidemiology of exposure and the human antirabies prophylaxis most representative of the procedures and practices used throughout the United States. It became apparent, however, during the collection of these data that no single, meaningful pattern could be developed showing why and how persons exposed to rabies were treated. Only seven major jurisdictions were represented in our study, and even among them there were significant differences in the epidemiology of exposure and the treatment that they administered. Although some factors such as age, sex, and month of exposure did not vary appreciably among the reporting areas, other factors such as the species of animal involved, the treatment regimen, and the period of time before treatment did.

The species of animal involved varied significantly according to the reporting area, and this variation influenced in turn the anatomical site and the kind of exposure reported. The treatment regimen and the

elapsed time before treatment varied more by reporting area than the other treatment factors studied. There may be valid reasons for such differences; again the species of animal involved seems important. For example, there are several acceptable alternatives in the management of exposures involving dogs or cats. If the biting animal is available, health officials may elect to examine the animal immediately, and if it is found rabid, initiate treatment of the person bitten; or they may elect to defer treatment and place the animal under observation for 10 days. Similarly, treatment may be initiated if the dog or cat is not immediately available, and treatment then may be terminated if the animal is later found to be healthy. Because of these and other variables, one must be cautious in drawing conclusions about the quality of medical treatment provided to persons exposed to rabies in the geographic areas we studied. Nevertheless, an average delay of more than 2 days before the initiation of treatment of persons exposed to wild animals indicates a significant deficiency.

The age and sex distribution of the persons given antirabies treatment in our study and the seasonality of exposure that we found are similar to those described in earlier studies (2-4). In our report, males 10-19 years old were the group at highest risk of exposure to rabies, and most exposures occurred during the summer. In earlier reports similar distributions of risk have been explained as being a function of increased contact between young males and animal rabies vectors during the warm months (5-10). However, our results show that juvenile males remain the group at highest risk regardless of the period examined.

Some interesting comparisons can be made between the frequency of treatment of human beings for rabies in 1972 in the jurisdictions in the study and the number of rabid animals reported (table 6). Recognition of the presence of rabies in an area apparently was often not a major factor in the decision to administer rabies treatment. New York City, which had no canine rabies, treated the most persons (449) for possible exposures to rabies from dog bites of any jurisdiction studied except North Dakota. This city, however, has subsequently revised its policy on antirabies treatment, and far fewer treatments are now given (11). It would have been desirable to examine the persons exposed to proven rabid animals as a subcategory within the group of persons treated, but unfortunately the data were not adequate for such an examination.

The treatment rate in our study was 2.9 persons per 100,000 population (table 6). In 1972, the net distribution of duck embryo vaccine for the entire

United States was 381,000 doses. If we assume 12 doses per treatment (our study average), the estimated treatment rate for the country would have been 11.5 per 100,000 or four times greater than in our study. If the traditional estimate of 30,000 persons treated annually in the United States is used, the treatment rate become even higher—14.2 per 100,000. Why the treatment rates in our study were lower than the national estimate is conjectural. It seems probable, however, that those areas with the most complete data—the areas that we used in our study—may also be those in which exposures are most critically evaluated, and therefore where treatment is most judiciously administered.

Conclusion

We believe that although our results are based on a more comprehensive data base than those in earlier reports, the inherent variability in rabies epidemiology and treatment throughout the United States precludes

Table 6. Number of persons treated with rabies vaccine, number per rabid animal, and number per 100,000 population, by jurisdiction

Jurisdiction	Persons treated	Persons treated per rabid animal	Persons treated per 100,000 population
Delaware	5	0.7	0.9
Florida	106	1.2	1.7
Georgia	98	0.9	2.1
Illinois (exclusive of Cook County-Chicago area) .	147	0.5	2.0
New York City	465	(¹)	5.8
North Dakota	95	0.6	15.3
South Carolina	49	3.8	1.8
Total	965	1.5	2.9

¹ None of animals were proven rabid.

the development of a single, meaningful composite of why and how people are treated. However, as the surveillance of exposure and of treatment improves, the knowledge gained from the more effective antirabies programs can be used to strengthen the others and to ensure that ultimately prevention programs of high quality will be in effect everywhere.

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SYNOPSIS

WINKLER, WILLIAM G. (Center for Disease Control), and KAPPUS, KARL D.: *Human antirabies treatment in the United States, 1972. Public Health Reports, Vol. 94, March-April 1979, pp. 166-171.*

Data were examined on 965 persons treated in six States (Delaware, Florida, Georgia, Illinois, North Dakota, and South Carolina) and New

York City in 1972 for possible rabies exposure. Males 10-19 years were found to be the group at greatest risk, and exposures occurred most frequently during the warm months. Dogs, other domestic animals, and wildlife were about equally responsible for human exposures in the six States, but 99 percent of the exposures in New York City involved dogs.

Antirabies postexposure prophylaxis varied markedly among reporting areas and frequently did not follow current recommendations. The mean delay in initiation of treatment after exposure was 4½ days. The mean number of doses of vaccine for treatment was 12; only 10 percent of the persons treated received antirabies serum.